Noise impact assessment of a proposed external classroom

North Bridge House Prep School

Client: MAP Architecture

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CONTENTS

0. SUMMARY

0.1. ACA Acoustics Limited has been commissioned to assess the acoustic impact of a proposed external teaching area at North Bridge House Prep School on nearby noise-sensitive properties.

0.2. A sound level survey has been carried out between the 8th – 9th December 2021 at a position at rooftop level of the proposed external teaching space, representative of the acoustic soundscape at the most affected noise sensitive residential dwellings. Whilst on site, the author considered the sound climate during the daytime was modest and comprised primarily of activity from the school, alongside road traffic on nearby routes. Existing ambient sound levels during the daytime were measured at LAeq 61dB.

0.3. A computer model has been set up to calculate sound emissions from use of the proposed outside teaching space to nearby existing residential occupants. Calculated noise emissions from the teaching space are LAeq 54dB to the closest residential properties, which are located at top floor level of 3-5 Gloucester Avenue, and are nominally 12 meters from the development site. This equates to a "*None/Not Significant*" impact when assessed in accordance with the Institute of Environmental Management and Assessment's *Guidelines for Environmental Noise Impact Assessment* and will be below the Lowest Observed Adverse Effect Level, as defined in the National Planning Policy Framework and Planning Practice Guidance – Noise.

0.4. The assessment includes benefit of the proposed 2m high glass balustrade around the proposed teaching area. A comprehensive management plan will be implemented, to mitigate against the potential for higher sound levels.

0.5. In accordance with relevant Policies, Standards, and guidance documents, it is the author's opinion that the site is suitable for use as an external teaching space.

1. INTRODUCTION

ACA Acoustics Limited has been commissioned to carry out an acoustic assessment of a proposed external teaching space at North Bridge House Prep School, London and to recommend acoustic mitigation treatment where necessary.

Assessment of the external classroom has been undertaken in order to ensure levels from the classroom in use will not be detrimental to the amenity of nearby residential occupants.

This report presents the results of the assessment.

2. RELEVANT POLICIES, STANDARDS, & GUIDANCE DOCUMENTS

2.1 Noise from The Proposed External Classroom

There is no specific British Standard or guidance document which considers noise emissions from children using an external classroom. Therefore, it is necessary to consider guidance within other relevant Standards and documents. Discussion of these is provided below.

2.1.1 National Planning Policy Framework and Noise Policy Statement for England

The National Planning Policy Framework (referred to as NPPF) sets out the Government's planning policies for England and provides guidance on how these are expected to be applied, providing a framework within which Local Authorities can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Paragraph 174 of the NPPF states that,

"*Planning policies and decisions should contribute to and enhance the natural and local environment by … e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability*".

Paragraph 185 also talks specifically about noise and advises,

"*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

- *Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life.*
- *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*."

The Government's long-term policy aims relating to noise are contained in the Noise Policy Statement for England (referred to as NPSE). Stated aims of the NPSE are:

"*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy of sustainable development:*

- *Avoid significant adverse impacts on health and quality of life,*
- *Mitigate and minimise adverse impacts on health and quality of life, and*
- *Where possible, contribute to the improvement of health and quality of life.*"

Paragraphs 2.19 to 2.24 clarify the above aims, referring to established concepts from toxicology; NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level). It also introduces a new concept relating to *"significant adverse*" of SOAEL (Significant Observed Adverse Effect Level), however noting,

"*It is not possible to have a single objective noise-based measure that describes SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times*".

The first aim of NPPF Paragraph 185 and the second underlying aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development, as set out in the NPPF. As neither the NPPF nor NPSE includes any numerical criteria, it is necessary to consider guidance provided in other documents to determine suitable limits that would define the LOAEL on an individual basis.

Finally, it is also of benefit to consider Paragraph 2.7, which advises that,

"*… the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications*".

This provides clear guidance that noise must not be considered in isolation but as part of the overall scheme taking into account the overall sustainability and associated impacts of the proposed development; there is no benefit in reducing noise to an excessively low level if this creates or increases some other adverse impact. Similarly, it may be appropriate in some cases for noise to

have an adverse impact if this is outweighed by the reduction or removal of some other adverse impact that is of greater significance to the development.

2.1.2 Planning Practice Guidance – Noise

Related to the NPSE and the NPPF, The Department for Communities and Local Government has published additional guidance and clarifications within the Planning Practice Guidance – Noise (PPG-N), available at https://www.gov.uk/guidance/noise--2.

Paragraph 003 of the PPG advises,

"Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- *Whether or not a significant adverse effect is occurring or likely to occur;*
- *Whether or not an adverse effect is occurring or likely to occur; and*
- *Whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure … is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

This guidance is like that set out in the NPPF and NPSE, however, Paragraph 005 of the PPG provides outline guidance on the definition of '*significant adverse effect*' and '*adverse effect*'. A copy of the table appended to Paragraph 005 is repeated below.

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Figure 1: Noise exposure hierarchy, taken from Planning Practice Guidance - Noise

Although this table provides descriptive definitions for the NOEL, LOAEL and SOAEL, as with the NPPF and NPSE there are no numerical values provided.

2.1.3 British Standard BS 8233:2014

The introduction to the Standard advises that,

"Noise control in and around buildings is discussed in this British Standard guide on an objective and quantifiable basis as far as is currently possible. For many common situations, this guide suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria for most people."

It also notes that,

> "*the standard is intended to be used routinely where noise sources are brought to existing noise-sensitive buildings*".

Section 7.7.3.2 relates to design criteria for external noise and recommends,

> "*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB LAeq,T with an upper guideline value of 55dB LAeq,T which would be acceptable in noisier environments*".

These criteria may therefore be considered to equate to the level of LOAEL, defined within the NPSE, NPPF, and PPG-N. Section 7.7.3.2 continues that,

> "*It is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres … a compromise between elevated noise levels and other factors, such as … making efficient use of land resources … might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*".

This compliments guidance within the NPPF, such that significant adverse impacts are avoided, but adverse impacts are mitigated and minimised to the lowest practicable level.

The author considers that an upper criterion of $L_{Aeq,\ 16\text{-hour}}$ 55dB should be targeted to minimise adverse impacts on the amenity of nearby residential occupants. It is of benefit to consider that children will only be outside for a portion of the time and therefore the overall 16-hour sound level will be consequently lower than the level calculated from the classroom.

The BS 8233:2014 upper desirable limit of $L_{Aeq,\ 16\text{-hour}}$ 55dB has been established based on guidance from the World Health Organisation's "*Guidelines for Community Noise 1999*". It is important to note however that the National Physics Laboratory has reviewed the WHO guidelines and advised that,

> "*Exceedance of the WHO guideline values does not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher levels of noise exposure are reached.*"

This confirms that the $L_{Aeq,\ 16\text{-hour}}$ 55dB limit is not the SOAEL but is likely to be between the LOAEL and SOAEL, fully acceptable in accordance with the NPPF, NPSE, and PPG-N so long as potential adverse impacts have been mitigated and minimised where practical, within the framework of sustainable development.

2.1.4 IEMA Guidelines for Environmental Noise Impact Assessment

Noise emissions from the external teaching space will comprise almost exclusively of children's voices. While BS 8233:2014 establishes the upper limit there is no specific formal methodology for undertaking an assessment of noise from voices potentially affecting nearby residential occupiers. A general principle that can be employed in situations of potential noise disturbance where there is no formal assessment methodology is to consider whether the new noise source will likely cause a significant increase over the current sound level or a change of character compared to the existing noise climate.

The basis for this form of assessment is discussed in the *Guidelines for Environmental Noise Impact Assessment*, written by the Institute of Environmental Management and Assessment (IEMA).

Having established the likely change in sound levels due to the new activity, an initial indication of the significance of the change can be determined from the table below, taken from Table 7-12 of the Guidelines.

Effect Description	**Definition**
None / Not significant	Less than LAeq 2.9dB change in sound level and/or all receptors are of negligible sensitivity to noise.
Slight	A LAeq 3dB to 4.9dB change in sound level at a receptor of some sensitivity.
Moderate	A LAeq 3dB to 4.9dB change in sound level at a sensitive or highly sensitive receptor, or a greater than LAeq 5dB change in sound level at a receptor of some sensitivity.
Substantial	Greater than LAeq 5dB change in sound level at a noise-sensitive receptor, or a LAeq 5dB to 9.9dB change in sound level at a receptor of high sensitivity to noise.
Severe	Greater than LAeq 10dB change in sound level at a receptor of high sensitivity to noise.

Table 1: Effect descriptors for change in sound level taken from Table 7-12 of the Guidelines for Environmental Noise Impact Assessment

Note that defining the change of loudness to one decimal place is not a reflection of the accuracy of any assessment undertaken but rather to provide a clear threshold between adjacent effect descriptions.

Section 7 of the Guidelines advises that the change in sound level provides an initial estimate of the impact, which should then be examined considering the context of the development, the type of noise source, nature of the change, and other factors. Paragraph 7.6 summarises that,

> "*In some situations, the conclusions about the degree of the impact will be clear and straightforward; but in others it is likely that, ultimately, a professional judgement will have to be*

made by the assessor. It must be remembered that the effects of noise are primarily subjective, and while it is desirable to include as much objectivity as possible into the assessment process in order to obtain consistency, there should be no concern in allowing professional judgement to come into the final analysis. However, the basis for the judgement made must be clearly set out so that it is clear how the conclusion has been reached."

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

The development site is located at North Bridge House Prep School, Gloucester Avenue, London.

The surrounding area is predominantly residential properties. Residential windows at top floor level of 3-5 Gloucester Road have been identified as the most sensitive windows.

An aerial photograph of the site and surrounding area, taken from Google Earth, is shown in Figure 2 below. The figure shows the location of the external teaching space, closest sensitive receptor, and measurement position.

Figure 2: Aerial photograph of the site - Available at www.google.com/maps

It is anticipated that the classroom will be used during school hours only, and would never be used outside of the hours of 07:00 and 19:00 hours.

4. BACKGROUND SOUND LEVEL SURVEY

To assess the acoustic impact of the new classroom it is necessary to establish the existing residual and background sound levels in the vicinity. Details of the sound level survey carried out by ACA Acoustics are provided below.

A single measurement position was selected at flat roof level of the proposed external teaching space. This location was considered to be a worst-case position, due to the sheltered nature of the position, screened from nearby noise sources. The closest noise sensitive windows will have less screening to nearby roads and background sound levels outside these windows will be consequently higher. This means the potential impact at these windows will be less than indicated by this report, ensuring a robust assessment.

The site was considered secure and therefore an unattended survey was carried out over nominally a 24-hour period between 8th – 9th December 2021.

Weather conditions at the time of setting up the survey consisted of a temperature of 9^{o}C, 20% cloud with negligible wind and dry ground conditions. Weather conditions have been reviewed at www.worldweatheronline.com, using the closest available commercial weather station. The extended nature of the survey ensures that a reasonable sample of results have been recorded with appropriate weather conditions and meteorological conditions are not considered to have adversely impacted the outcome of the assessment.

Sound level measurements were recorded in terms of 15-minute samples of overall LAeq, LA90, and LAfmax values along with other statistical indices and octave band spectra.

The following equipment was used during the survey; the sound level meter was calibrated before the survey and checked after with no deviation noted.

Equipment	Serial Number
Rion Class 1 sound level meter type NL-52 complete with weatherproof and lockable outdoor environmental kit	00564867
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	83826

Table 2: Equipment used for the sound level survey

Results of the survey are shown in graphical form in Figure 3 below.

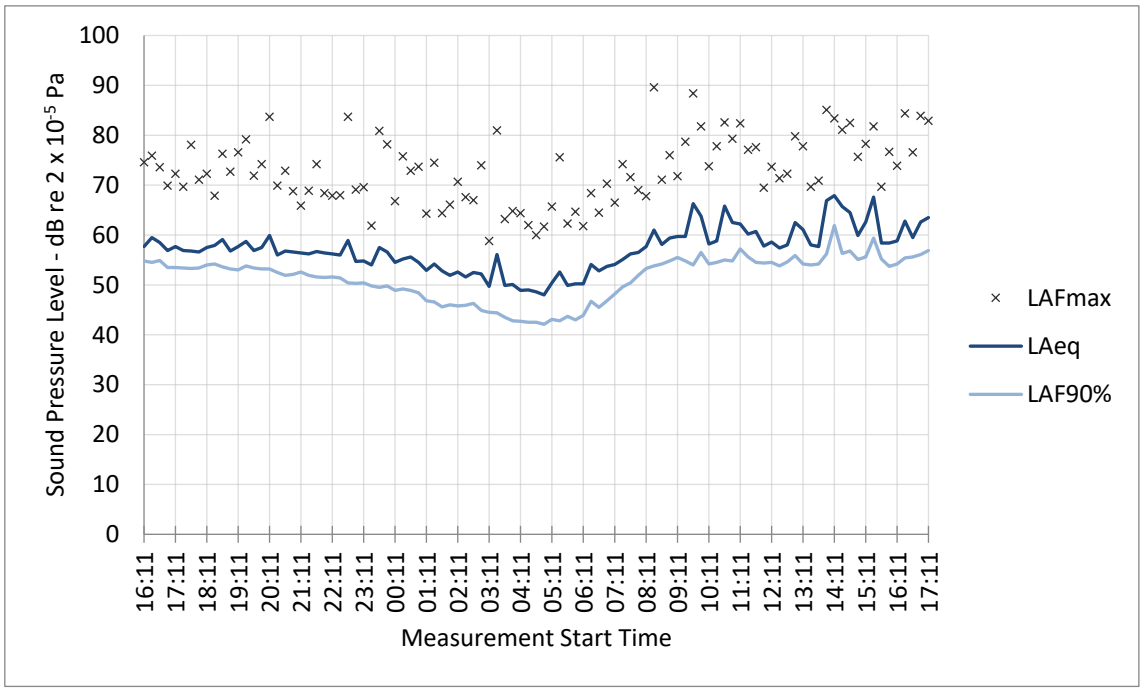


Figure 3: Sound level survey results

Summary results are shown in Table 3 below. As the classroom is only operating between the hours of 07:00 – 19:00, the values shown below are for these time periods.

Date	**LAeq 07:00-19:00**	**LAfmax 07:00 – 19:00**
(8th – 9th December 2021)	61dB	82dB

Table 3: Summary sound level survey results

The 10th highest measured LAfmax values over the daytime period between 07:00 and 19:00 have been reported as being representative of a typical 'high' LAfmax value.

5. NOISE IMPACT ASSESSMENT OF EXTERNAL TEACHING SPACE

To calculate noise emissions from the proposed external teaching space to noise-sensitive properties in the vicinity a computer calculation model has been set up using iNoise, a proprietary noise mapping software, based on the calculation procedures of ISO 9613-1/2 standards and the associated ISO 17534 quality standard.

Based on a previous study of sound levels within classrooms (*External and Internal Noise Surveys of London Primary Schools, February 2004, Bridget Shield and Julie E. Dockrell*), Source sound levels

within classrooms consisting of individual work and movement around the classroom were LAeq 72dB. The proposed development is outside, and so a 3dB correction has been included to account for a lack of ceiling reflections. The computer model uses a source sound power level of LAeq 86dB, equating to a sound pressure level within the centre of the external teaching space of LAeq 69dB.

The model incorporates the proposed glass screen around the teaching space. This screen, along with the parapet wall it is on top of, has a cumulative height of 2 meters.

Printouts from the computer calculation model are provided in Appendix A. Calculated sound emissions from the teaching space to 1m outside the closest noise sensitive residential property is shown in Table 4 below.

Receptor Location	Sound Level from external classroom	Existing Residual Sound Level	Cumulative Change in Sound Level
Windows of upper floor flats at 3-5 Gloucester Road	LAeq 54dB	LAeq 61dB	<1dBA
Rear windows of upper floor flats on Regal Lane	LAeq 50dB	LAeq 61dB	0dBA

Table 4: Summary noise emissions from play garden to adjacent noise-sensitive properties

Table 4 confirms that the highest 1-hour noise emissions from the proposed external teaching space will cause a cumulative increase to the existing residual sound level of less than 1dBA. When assessed in accordance with the IEMA Guidelines, as shown in Table 1 this gives an initial impact of "*none/not significant*".

The study of sound levels in classrooms indicated that the highest measured levels occurred when children were undertaking group work activity, with sound levels of LAeq 77dB. Correcting the acoustic model pro rata for these highest activity levels equates to a level at the receptor of LAeq 59dB. This remains below the existing residual sound level and would result in a cumulative change in the overall sound level of 2dBA. This confirms that even during occasional higher noise activity in the classroom, noise emissions would not result in significant adverse impacts on neighbouring residents.

In accordance with the IEMA Guidelines the calculated initial impact should be corrected, taking into account the context of the development. Relevant factors which should be considered are shown in Table 7-2 of the Guidelines and have been used as headings to guide the assessment in the table below.

Factor	Issue	Discussion
Averaging period	Is the averaging time so long that it might mask a greater impact at certain times, or does	The external teaching space will be open for a reasonable proportion of the day, but with breaks between

Factor	Issue	Discussion
	the noise change occur for such a small proportion of the time that it therefore can be considered of little consequence?	lessons. Sound levels have been calculated for activity in the external classroom. Taking into account these break periods the cumulative impact on all neighbouring properties would be even lower than the levels shown and would equate to a negligible impact. However, considering the impact over the full day may mask short term impacts and therefore the selected period of 1-hour is considered the most appropriate.
Time of day/night/week	Is the change occurring at a time that might increase or reduce its effect from that implied by the basic noise change?	The teaching space will only be open between 07:00 and 19:00 hours. These daytime hours reduce the impact.
Nature of the noise source	Is there a change in the nature of the noise source which might alter the effect?	The site is an existing school, which is audible at the nearby receptors, ensuring the acoustic character of the area would not be changed. This reduces the potential noise impact.
Frequency of occurrence	How does the frequency of the occurrence of the noise source affect the effect?	The classroom will be open daily. This regularity may have a slight increase in the potential for adverse impact.
Spectral characteristics	Is there a change in the spectral characteristics which might affect the effect?	As discussed above, the nature of the source would likely not have an impact on the spectral characteristics compared to the existing acoustic environment at the receptor. This will reduce the impact.
Noise indicator	Has the indicator(s) which best correlate with the specific effect been correctly identified? (i.e. does the change in level as described by the indicator used adequately reflect the change that would be experienced by those exposed to it and could be affected by it?)	The external teaching space will be in use over a reasonable portion of the day and therefore the LAeq – equivalent energy averaged sound level – has been used. The space will be used as a classroom, and it is anticipated that for this use the LAeq is an appropriate metric for use within the assessment Occasional instantaneous events such as shouts or laugher may be audible, and the LAfmax index could be used to

Factor	Issue	Discussion
		assess this short term impact. However, in this instance the site is already a school and there would be no change to the character of the noise which would currently contain similar shouts/laughter from children throughout the day therefore the change in sound level provides the most appropriate assessment method.
Absolute level (benchmark)	How does the change relate to any applicable published guidance?	BS 8233:2014 recommends that to provide a reasonable standard of amenity, sound levels outside a residential property should ideally achieve a level of $L_{Aeq,\ 16\text{-hour}}$ 55dB. The calculated sound level over the 10-hour period the teaching space will be in use is $L_{Aeq,\ 10\text{-hour}}$ 54dB. Sound levels later into the evening, once the play garden has closed, will be lower further reducing the 16-hour average level. This ensures use of the play garden will not cause the average level to exceed the BS 8233 guideline limits and there is no increase to the potential for adverse impact.
Impact and assessment of effects	Taking the relevant factors into account, as discussed above, the author considers that the proposed development will have a slightly lower adverse impact than the initial numerical assessment, however when considering guidance in **Error! Reference source not found.** and Table 1, the use of the classroom will remain at an impact of "none/not significant" The proposed external classroom would be heard but would not result in any change in behaviour or attitude of adjoining occupants.	

Table 5: IEMA Assessment factors and assessment outcome

As discussed in Table 5, in accordance with relevant Standards, guidance documents, and government planning policy it is the author's opinion that the noise impact of the proposed external classroom should not be detrimental to the amenity of nearby residential occupants and the site is suitable for the proposed development.

6. NOISE MITIGATION SCHEME

To protect the amenity of nearby residents further it is recommended that an appropriate management plan is put in place. Whilst development of a full management plan is outside the scope of ACA Acoustics and would be established by the operator of the premises, taking into consideration their own preferred working practices, it is anticipated a suitable plan is likely to incorporate the following elements relating to the external classroom:

- Outdoor areas should only be used between the hours of 07:00 and 19:00. Areas should not be constantly used, and the teaching space will contain periods of inactivity during the day.
- Staff should be mindful of residential neighbours and use calm, gentle voices when interacting with children and others.
- Incorporate awareness of noise-management issues into regular staff training.
- An appropriate procedure should be put in place to enable the prompt investigation should any complaints or concerns be raised by nearby residents.

7. CONCLUSION

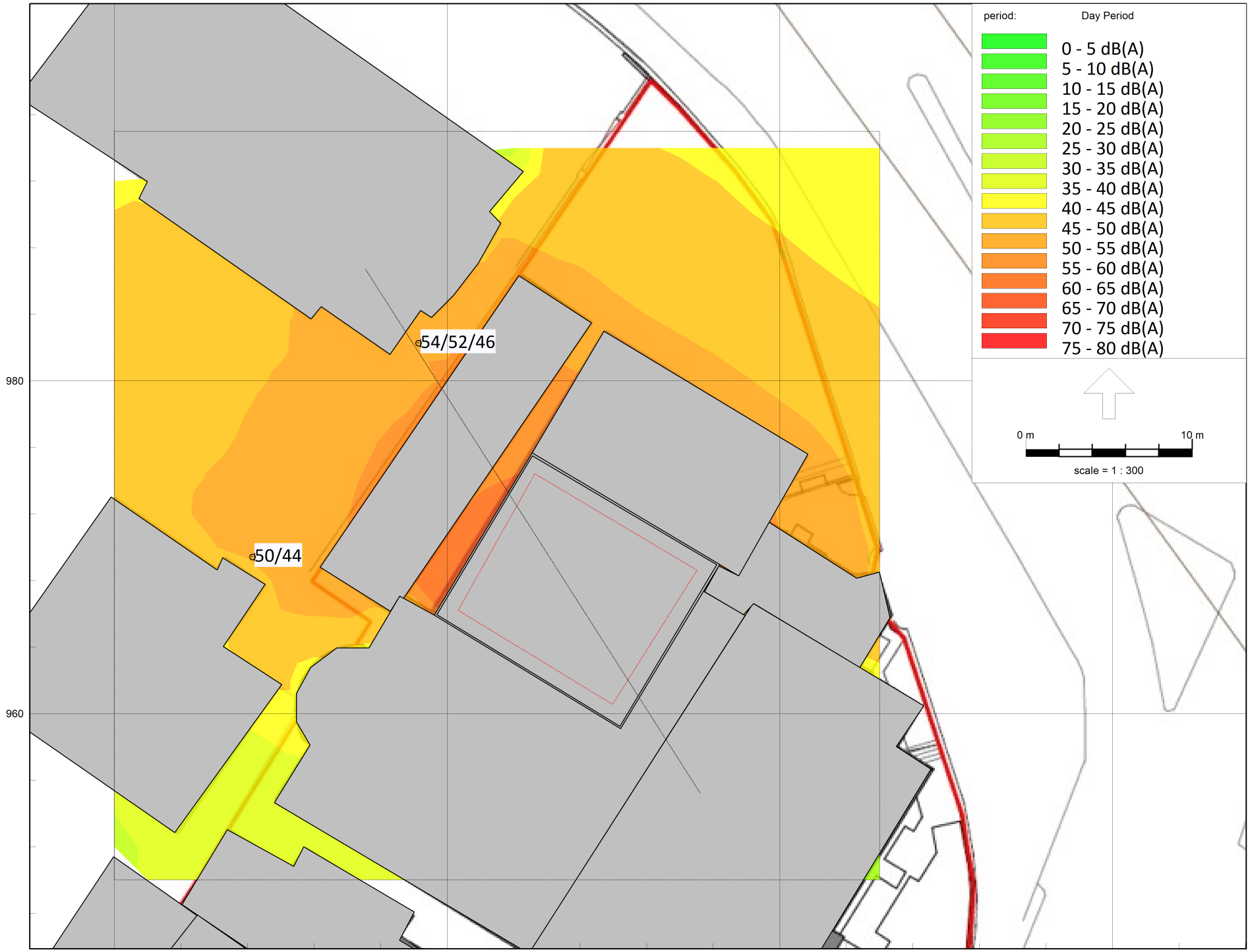
The client is preparing a planning application for a proposed external classroom at North Bridge House Prep School, London.

It is the author's opinion that the acoustic impact of the proposed external classroom to the closest sensitive residential dwellings will be low. The assessment includes the benefit of a proposed screen around the perimeter.

The site is suitable for the proposed development with no further noise mitigation measures necessary.

Appendix A

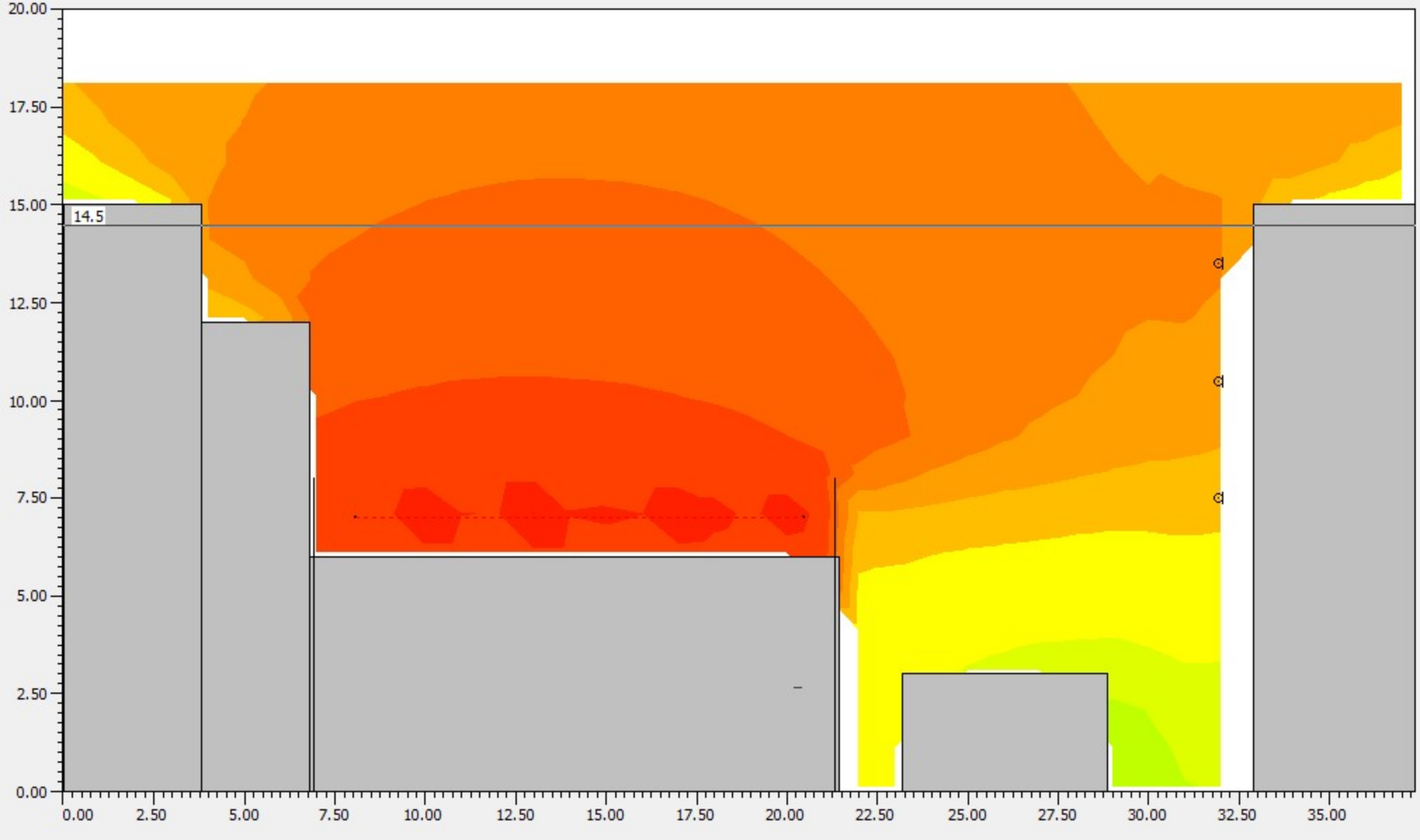
Computer Noise Map Print-Out of External Teaching Space



External teaching classroom
20 Dec 2021, 16:00

Tommy Burn - ACA Acoustics

Industrial noise - ISO 9613.1/2, [version of Area - initial model] , iNoise V2021 Free Licensed to Tommy Burn - ACA Acoustics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